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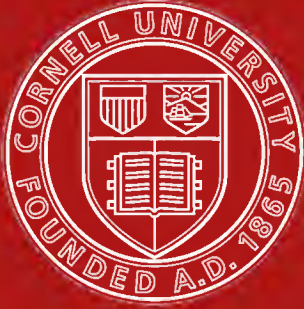
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The Objectives in Agricultural Cost Accounting

(Paper to be read at the meeting of the
American Farm Economic Association, at
Chicago, Illinois, December 28-30, 1922).

By

Henry C. Taylor

Your president asked me to address this meeting on the relative merits of the survey method and the daily record method of gathering cost materials. I requested that instead of discussing the relative merits of any of the systems of cost gathering, I be permitted to address you on "The Objectives in Agricultural Cost Accounting," and by the term cost accounting I mean the assembling and interpreting of the items of cost and returns in the broadest sense.

I prefer to give only passing attention on this occasion to the methods of assembling cost data desiring rather to give especial attention to the uses to which they may be put in solving important economic problems. If I were to enter upon a discussion of methods, the time would be spent in discussing the relative merits of the different degrees of intensity represented by the detailed cost records on the one hand, where every move of labor and equipment and all trans-

actions are recorded from day to day in complete detail, and by the survey method on the other hand where the investigator visits the farm once and records the principal activities and transactions of the year. Attention would need to be given also to enterprise studies by the route method where specific limited information is collected from day to day or from month to month. If we had time to complete such a discussion we would probably conclude that, for a complete analysis of what happens on the farm the complete record is very important, for securing enterprise costs the intermediate method is satisfactory and for securing a general picture of the relative results obtained by a large number of farmers operating by more or less different methods, the survey is exceedingly valuable. One of the important differences between the intensive and the extensive systems of securing cost data is that the intensive method is the more expensive and places greater limitation on the extent and timeliness of the investigation. Another important phase of the two methods is the extent to which estimates are used in each and the degree of accuracy in these estimates. It must be borne in mind, however, that any system of accounting includes large numbers of estimates and that the degree of accuracy needed will depend on the nature of the problem to be solved.

When we turn from methods of collection to methods of analyzing and interpreting cost data, a whole series of difficult problems arises which, in some measure, limit the value of data secured by any method.

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One of the most difficult of these problems centers about the question of joint costs, i. e. costs shared by two or more lines of production. These costs are very numerous in all types of farming, though less complicated in areas of specialized production than in the mixed farming of the corn belt. In addition to the problems of allocation of joint costs, there are such questions as the rates of charge for home grown feeds used by livestock, and the rates for the labor and power used on the different undertakings.

Consideration of all the problems involved in the collection and analysis of cost data would lead to the conclusion that each of the methods has merit and that the method to be used for a particular problem should be selected according to the purposes in view. The first step, therefore, in clarifying the problems of agricultural accounting is a statement of the objectives for which we are striving.

Probably the most important purpose of agricultural accounting is to furnish the basis of making a choice between two or more lines of production. One of the first choices a farmer has to make is the choice of crops. Shall the southern farmer put this field into cotton or corn? Shall the northern farmer put that field into oats or barley? Shall he produce clover or alfalfa for hay? These are decisions the farmer must make. With or without cost data a decision will be made and action proceed from year to year, but accurate cost data properly interpreted should greatly increase the accuracy of the judgment of the

farmer. Keeping choice of crops in mind as an objective, what kind of cost data is required?

Relative profitableness, or relative return to the farmer, decides the choice of crops. If profits are to be measured in terms of the returns to the factors of production it becomes obvious that to be of most value for the purpose of making selection, this measure should be made in terms of returns per unit of that factor of production which makes the principal demand for managerial activity. It may so happen that for certain crops with similar labor demands the return to land provides the simplest basis of comparison, whereas between other competing crops it may better be measured in terms of man hours. When comparing two crops that demand widely different amounts of labor, as tobacco and corn, where tobacco made a \$48.50 return per acre, compared with a return of \$18.50 an acre for corn, but where corn gave a return of 75 cents per man hour, and tobacco only 41 cents per man hour, as shown in Table 1, the measure of relative profitableness might better be made upon the basis of return to man labor rather than return per acre, for a man can operate several times as many acres of corn as of tobacco because of the larger labor requirement per acre of the tobacco.

The problem presents a different aspect in making choice between non-competing crops. When we have before us information which shows that corn on a particular farm, after paying all other expenses, returned 75 cents an hour for the human labor put upon it, whereas oats returned only 27 cents an hour for its labor; are we to conclude that the oats should be discontinued and the land put into corn? It is only when we

know the relation of oats and corn to each other in the system of farming that we can answer this question. If we should find that the larger the corn crop and the smaller the oat crop the greater the total farm profits, it would be a simple matter to conclude that the acreage of oats should be reduced or the crop possibly omitted entirely from the rotation. But if we find that the oat crop can be grown and harvested without interfering with labor-and-machinery demands made by the corn crop nor in any other manner decreasing the size of the corn crop which can be handled, and if it becomes evident that the corn crop is benefited by a system of rotation in which the oat crop, or some similar crop, is an important factor, we may decide that oats should be retained on the farm. This becomes clear when one bears in mind that the farmer tries to make up a labor program in which he will be doing at each season of the year the thing which adds most to his total net profits. An enterprise which makes demands upon labor and equipment at one season of the year may yield a very high profit, while one which requires attention at another time of year may yield but small returns, and yet add more to the total net profit of the farm than would any enterprise which could be taken on in its place.

TABLE I. Returns per acre and per hour of man labor from oats,
corn and tobacco, Wisconsin farm, 1916.

	Return per acre	Return per hour of man labor
Oats	\$ 6.90	\$.27
Corn	18.50	.75
Tobacco	46.50	.41

In other words, the farmer needs to have other data besides the total costs and returns for the various products before he can make the proper selection of enterprises. Nature, for instance, determines to a large extent what can or can not be done on the farm at any given time of year and this fact tends to bring about considerable variation in the demand for labor at different seasons of the year. As they are now conducted, none of the common live stock or crop enterprises supply a uniform demand for labor even though they may be the chief source of income on the farm. The result is that it is usually found to be profitable in most sections to add to the organization, enterprises that will furnish employment during the slack periods. These supplementary enterprises are used to salvage time that would otherwise be wasted and from the standpoint of farm organization alone must be considered profitable even though they may not give as large a return as the chief lines of production. In practical accounting it has not been the practice to reflect this supplementary and competitive relationship of enterprises in the costs, and for this reason the cost figures secured are sometimes too high and sometimes too low when compared with the figure which is demanded by farmers in deciding whether or not to grow a given crop. For a complete analysis of the problem other data than those usually included in costs and returns are necessary as, for instance, the seasonal distribution of the labor demand, soil character, relation of permanent pasture to crop land, etc., and the collection of these physical facts becomes therefore an essential part of farm cost accounting.

Turning our attention to the question of labor distribution, let us compare corn and oats. Table I shows the labor demand of these two crops for a southern Wisconsin dairy farm on which corn was one of the most important crops. The accounts for this year showed that corn returned \$13.50 per acre as against \$6.90 per acre for oats, and were we to rest our judgment entirely on the per acre returns as shown by the accounts, we would be forced to the decision that oats ought to be discontinued, but a glance at the chart tells us that the oat crop at no time interfered with corn production in its labor demand. The work on oats was performed in early spring and mid-summer when corn does not demand the farmer's attention. The only question is whether some other crop which is likewise supplementary to corn will pay better than the oats.

When the demands for labor and for equipment are made by competing crops, the problem does not present so many complications. Here the question can be handled by ascertaining the difference in the returns and differences in the items of costs which are not common to both. To the extent that the costs are common they can be cancelled in determining the relative profitableness of competing crops, and if so, why need they be given further consideration when choice of crops is the objective? This may sound like heresy, but note that I am speaking now only with regard to this particular use of cost accounts, namely, the making of choice between competing enterprises where some of the factors of production are common to both.

Let us consider conditions as they actually existed upon a Minnesota farm in the cropping season of 1921 and let us assume that we have the choice which this farmer had in the spring, that is, the choice of seeding a 30 acre field to barley or to oats. The farmer has found

by the use of cost records and personal observation that there are many operations and costs which are common to both crops.

The same land will be used whether seeded to oats or barley. While there is some choice as to methods to be used in preparing the ground for the seed bed let us say that this farmer decides to disc for either crop, then, as shown in Table 11, the labor and machinery required in discing, harrowing, and seeding will be identical for either crop. So as nearly as can be foretold, the operation of cutting the crops will be the same in the demands for man labor, horse labor, and equipment, and the time required to shock the crops will be practically the same. The general item of overhead and miscellaneous costs will be identical for 30 acres of either crop.

The items of seed, twine, and thrashing will not cancel as the others have done. The sum of these three items will amount to about \$25 more if the 30 acres are seeded to oats than if seeded to barley.

Turning to the products that will come from either line of production, the straw from either will in this case be of equal value on the farm. The farmer knowing this field and what it has normally produced believes he can reasonably expect a yield of 45 bushels of oats or 25 bushels of barley, and to the best of his ability he estimates that the price at the machine in the fall will approximate 40 cents for oats and 60 cents for barley. With these estimates in mind, the farmer will conclude that the 30 acres of oats will return about \$65 more than 30 acres of barley.

TABLE II.

METHOD OF SELECTION BETWEEN COMPETING CROPS

		OATS	BARLEY	AMOUNTS NOT CANCELLED
<u>LAND CHARGES</u>		30 acres	30 acres	None
<u>DISCING</u>	Man hours	30	30	
	Horse "	90	90	None
<u>HARROWING</u>	Man Hours	19	19	
	Horse "	62	62	None
<u>SEEDING</u>	Man hour's	20	20	
	Horse "	60	60	None
<u>SEED</u>	Bushels	80 @ \$.47	55 @ \$.60	\$ 4.60
<u>CUTTING</u>	Man hours	22	22	
	Horse hourse	63	63	None
<u>TWINE</u>	Pounds	104 @ \$.14	70 @ \$.14	\$ 4.76
<u>SHOCKING</u>	Man hours	40	40	None
<u>THRASHING</u>	Man hours	176)	144)	
	Hourse hours	233) \$59.90	196) \$43.40	\$10.60
<u>THRASHING</u>	(Cash cost)	\$49.34	\$44.52	\$ 5.26
<u>OVERHEAD AND MISCELLANEOUS COSTS</u>		\$ 7.40	7.40	None
Total additional cost of oats over barley				\$25.22
<u>VALUE OF PRODUCT</u>				
Grain	1350 bu.	\$540.00	750 bu. \$450.00	\$90.00
Roughage	30 tons	\$150.00	30 tons \$150.00	None
Difference in favor of oats				\$64.78

In the study of crop selection the objective of the accountant is the securing of basic information, such as the number of men and horses required and the amount of equipment needed for a given acreage which will give the basis for calculating the relative profitableness of different enterprises from time to time as changes in the prices paid for the instruments of production and for the products of production suggest the desirability of such action. It is obvious, therefore, that if our cost data are to be of direct use in this connection, they must be assembled as standards typical of different farms and different conditions, rather than simply as averages from numbers of farms operated in different areas.

The crops having been chosen, another purpose of agricultural accounting is to furnish a basis for making choice between two or more methods of carrying out a given line of production. For example, having decided what crops to produce, the farmer's next problem is that of the degree of intensity with which these crops should be cultivated. The corn-grower must decide whether to undertake the production of 50 acres of corn per man and team, or to limit the area to 40 or to 30 acres, with the expectation that the larger yield per acre to be secured by the more intensive culture will increase the total profits from the crop. Or the problem of the cotton farmer may be that of deciding the most profitable rate of application of fertilizer. The question is not the rate of application which will give the largest yield, but the application which will return the greatest net profit. A recent cost study of cotton farms in Alabama shows, as indicated in Table III, that an increase in the rate of fertilizer application was accompanied by an increase in the yield per acre.

TABLE III. Increasing profits per acre from increasing use of fertilizer.

Fertilizer:	Application:	Average application of fertilizer:	Land value per acre:	Yield of lint per acre:	Man hours per acre:	Mule hours per acre:	Profit per acre:
Group 1	250 pounds and under	208 pounds	\$85	216 lbs.	105	48	\$14
Group 2	400 to 251 pounds	331 pounds	82	268 lbs.	128	60	20
Group 3	Over 400 pounds	572 pounds	77	306 lbs.	133	57	25

Note: rates - Man labor, 14 cents per hour; mule labor 10 cents per hour; fertilizer \$50 per ton; seed, 50 cents per bushel; ginning \$4 per bale; use of land, 7% of value; and all other costs, \$7.75 per acre. Price of lint, 22 cents per pound; seed, \$25 per ton.

A balancing of receipts and expenses in the production of cotton for each groups shows that: Group 1 with a low application made a profit of \$14 per acre, while Group 2 with a medium application made a profit of \$20 per acre, and Group 3 with a high application of fertilizer made a profit of \$25 per acre.

It is evident that under existing conditions the liberal use of fertilizer returned a considerably greater profit per acre than did the use of a medium or low application. Whether or not this larger profit per acre will be attractive to the farmer depends upon whether or not he will be obliged to reduce his acreage of cotton in order to secure labor to pick the larger yield per acre.

To the accountant this represents a relatively simple problem because aside from cost of fertilizer and the cost of picking and ginning, the elements of cost are the same.

In the case of the different degrees of intensity of cultivating corn, I have not been able to turn my hand to available data. But were an experiment conducted in which a man, team and equipment were used continuously on the 30 acres, the 40 acres, or the 50 acres, the only variables which the accountant would need to watch would be rent, seed cost, and the value of the product, in order to determine the relative profitableness of these various degrees of intensity.

Neither of these examples illustrates the entire problem the farmer faces when deciding the acreage to be planted and the intensity with which it is to be cultivated. The accountant must recognize that the proportions in which labor and capital must be applied to the land to secure the greatest profit necessarily vary with changes in the relative costs of the factors of production and the price of the product. With the full problem in view he should assemble such facts with regard to rent, wages, equipment, and material as will enable the farmer to draw the right conclusions on the subject at any and all times.

In the choice of equipment many important questions are being raised. In the last decade the introduction of the tractor has set the farmer thinking in terms of the relative desirability of performing different farm operations with a tractor, with horses, or with both.

He has found that he needs to give attention not only to relative costs but to relative returns if he is to decide intelligently. Here is a case where the elements of cost are so entirely different that it seems necessary to get rather full information.

For instance, suppose that an Illinois farmer with 200 acres of crops is desirous of knowing whether or not to buy a tractor. The annual cost of using a two-plow tractor and of keeping a horse, on such a farm would be approximately as shown in Table IV.

TABLE IV. Cost of using a Tractor.

Annual depreciation.....	\$ 80
Fuel	75
Repairs.....	30
Interest	20
Oil	15
Other costs	10
Total	<u>\$230</u>

Cost of keeping a Horse

Feed	\$ 65
Depreciation	10
Interest	7
Stabling	7
Harness costs	2
Shoeing	2
Other costs	2
Total	<u>\$ 95</u>

The introduction of the tractor would allow for a reduction of at least two head of workstock and a corresponding reduction of \$190 in the yearly horse expense, leaving a net increase of \$40 in the yearly cost of power.

Against this \$40 increase there are items which are not always easy to evaluate but which must be considered before a proper conclusion can be drawn. Materials collected thus far are particularly lacking in information which will give us a measure of value to apply to those intangible items.

The tractor may make possible a reduction in expense for hired help, and if so, proper credit should accrue to the machine.

A tractor is satisfactory for a large amount of belt work and may save the cost of purchasing a stationary engine.

If custom work is done with the tractor, the revenue therefrom should be properly credited.

An increased crop yield may result from work done at the proper time or from work of a better quality, while on the other hand, the use of the tractor on soils which pack easily may reduce yields.

What value are we to attach to these and all the other benefits and drawbacks connected with these two forms of power?

Cost accounting can assist materially in giving the final answer to the problem. As cost studies continue in the field of farm power, careful measure must be made of the limitations of both the tractor and the horse, of the timeliness and quality of work performed by each and of other elements connected with farm power which are reflected in the farm income. These are factors which must be given due consideration in an interpretation of farm power figures. So long as these factors are not evaluated and entered into the account, it is necessary for the farmer to make estimates of their significance before drawing conclusions from the accountant's figure.

Having decided upon the crops to grow, the equipment to use, and the degree of intensity of culture, the problem of the most profitable method of disposing of these crops must next be solved. While some of the crops are definitely produced as feed crops and others as cash crops, there are many which may be fed or sold at the discretion of the farmer.

The answer to the question, "Shall I feed or sell my corn?" can not be made simply on the basis of the difference in the amount of cash received. A particular farming system is often contingent upon the amount of family labor at hand and the quantity of accessible capital. With the knowledge that local conditions are favorable to the production of certain crops the question arises as to whether the farming system shall include live stock enterprises. If live stock are included in the farming system, the question of available capital, the supply of labor, as well as costs and receipts, must be carefully analyzed as a basis for rational decision. In fact, the study of the whole question of crop and live stock selection can not begin and end with a consideration alone of expenses and income for the year from each line of production, but careful consideration must be given to the character of the expenses, and to the supply as well as the varying demands made by farm enterprises upon the different factors of production at each season in the year.

When the farmer comes to marketing his produce, he may have several choices. He may sell to a local independent buyer, ship directly to the central market on his own account, or enter a cooperative association organized for the purpose of marketing the commodity which he has for sale. Here costs as well as gross receipts must be taken into account because here, as in other cases, the net receipt is of primary consequence to the farmer.

The operations involved in the marketing of grain or live stock at central markets are very much the same, whether the farmer chooses to market his product as an individual through a commission merchant, or whether he joins with his neighbors in a local cooperative association.

But when the local cooperative association is a member of a federation which undertakes the functions of the middleman at the terminal market, it is a matter of considerable consequence to the farmer-member of the local association and to the public at large, to know whether or not these functions are performed more cheaply and as well, or better, by associated effort. These federations or cooperative selling agencies usually exact the same rates of commission as competitive organizations, but give a refund or a patronage divided at the end of the year, dividing their profits upon a prorata basis, according to the volume of business transacted through them by the constituent members.

The terminal charges, commission, yardage, feed, etc., which were assessed against the hog shipments of six associations in Nebraska by a cooperative selling agency, together with the refund or dividend are shown in Table V.

Table V.

Total Shipment of Hogs	Terminal charges at	Rate per
2,929,330 pounds	<u>Usual Rates</u>	<u>Thousand Pounds</u>
	\$4,593.30	\$1.57
Refunds on the above shipments by the Cooperative Commission Company		
\$1,345.90		.46

It may be noted from the example that while the refund secured through the cooperative agency amounts to nearly 30% of the total terminal charges, it amounts to less than 5¢ per hundredweight on the total stock marketed, and should the price secured by the cooperative organization average 5¢ less per hundredweight than might have been secured by a competitive agency, this apparent saving would be wiped out entirely.

In considering the merits of cooperative selling agencies, the quality of their services and the quality of services rendered by competitive agencies must be determined. The accountant's problem is to collect and analyze the records of a large number of cooperative associations and independent operators, with a view to determining the most efficient methods of marketing, when both the quality of the service and its cost are taken into consideration.

While the primary purpose of cost accounting is the assembling of facts and analyzing them with a view to giving the manager a more intelligent basis for passing judgment wherever a choice is open between two lines of action, cost accounting data have other important uses.

They give the basis for making comparisons between the returns secured in the different lines of agricultural production in the various parts of the United States. Such information is important to the educational forces which have for their purposes giving general direction to trends in agricultural development. This same material also gives the basis for making comparisons between returns in agriculture and other industries. For these purposes the results of our accounting must be generalized and supplemented so as to show costs and profits in the various lines of production and the trends of costs and profits from year to year.

Furthermore, just to the extent that it is thought desirable for the Government to influence prices by tariff legislation or other means, cost accounting data form a considerable part of the basis for intelligent action. The authority now vested in the President and the Tariff Commission makes necessary the giving of much attention to gathering and analyzing agricultural costs. It is true also that farmers who associate themselves together for the purpose of collective bargaining are likely to go very badly wrong if they are not guided by such facts as proper cost accounting will provide. Not only is there danger that they may temporarily and in specific cases unduly enhance prices, which will bring them under the action of the Capper-Volstead Act, but they may also over-stimulate production and in the long run depress prices below the proper point in spite of any power of collective bargaining the association may have.

It has long been held by economists that where there is no interference with the action of competitive forces, prices tend to approximate marginal costs. If this general truth is kept in mind in our definition and interpretation of the elements of cost and cost rates, we may be able to use our results in determining whether the price is being unduly enhanced by concerted action. But accounting figures may be misleading and of little value for this purpose. Unless particular attention is given to the proper determination of charges for the use of land, unpaid labor and other non-cash items, and to the costs incurred by new producers who have entered the field on account of rising prices,

The acreage of most farm crops and number of live stock can be expanded or contracted more or less at will and most of these can be expanded rapidly if the price becomes sufficiently attractive. As crop area is ex-

panded to take in those acres which normally would not be put into the crop and as the intensity of culture changes in an endeavor to increase the volume of production, a price which will meet the costs of the marginal group will constantly require revision upwards.

I have attempted to enumerate some of the major objectives in agricultural cost accounting and to point out the wide range of usefulness of cost data. Such data can be made to throw much light on most of the problems with which the agricultural economist has to deal. It is evident that no one method of assembling and analyzing cost data will suffice for the many and varied purposes for which they are to be used. The accounting procedure must depend upon the objective -- the question to which we are seeking an answer. And if the results are to be of assistance in answering the questions which will confront us in the future, they must be expressed in terms which admit of modification from time to time to conform to changes in cost rates and prices of products.
